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is also a brief account of the marine laboratory at Misaki. The last essay is by Professor MacMillan on *The kelps of Juan de Fuca.* There are seventeen genera of kelps found in the Straits of Fuca, which is more than half of the total number in the Laminariales. The habits and many of the structural peculiarities of these are described in a popular style and illustrated with several excellent figures.— B. M. DAVIS.

PROFESSOR MÖBIUS[4] has published in book form his laboratory directions for beginners. The book contains eighteen exercises, each intende to occupy about three hours. Directions are given for making sixty-five preparations, of which forty-two are phanerogams and twenty-three cryptogams. Almost without exception, the methods are those employed for examining fresh material, no microtome being used and almost no attention being given to imbedding or staining. In this country subject-matter like that contained in this book is usually presented by the teacher in the laboratory CHARLES J. CHAMBERLAIN.

NOTES FOR STUDENTS.

MONTEVERDE[5] states, in a preliminary notice, that protochlorophyll is not a yellow pigment, but is like chlorophyll in color and fluorescence. Etiolated leaves contain a certain amount of this substance, which begins to go over into chlorophyll as soon as these are brought into the light. In light, protochlorophyll is formed as fast as it changes into chlorophyll, and if green plants are placed in darkness this process sometimes continues until the green of the leaves is heightened by the accumulation of the former compound.— BURTON E. LIVINGSTON.

MOLISCH[6] finds the phosphorescent bacterium, *Micrococcus phosphoreus* Cohn, to be common and widely distributed instead of rare and sporadic as generally supposed. It is found upon meats in refrigerators and cold-storage houses, abattoirs, butcher shops, and kitchens into which flesh of slaughtered animals is regularly brought. To secure this species for study it suffices to dip a piece of fresh beef, veal, or pork into a 3 per cent. NaCl solution, to lay it in a dish half immersed in the same solution and keep it at 9–12° C. in a moist chamber. 89 per cent. of beef tested in this way showed luminescence. As the species dies quickly at the temperature of the human body it probably cannot be injurious if eaten. A revised description is given with illustrations.— C. R. B.

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[4] MÖBIUS, M., Botanisch-mikroskopisches Praktikum für Anfänger. 8vo. pp. ix + 2. *figs.* 12. Berlin: Gebrüder Borntraeger. 1903.

[5] MONTEVERDE, N. A., Das Protochlorophyll und Chlorophyll. Bull. Jard. Imp. Bot. St. Petersburg **2**: 181–182. 1902.

[6] MOLISCH, HANS, Ueber das Leuchten des Fleisches, insbesondere todten Schlachtthiere. Bot. Zeit. $\mathbf{61}^1$: 1–18. *figs.* 5. 1903.

THE PRINCIPAL points in our knowledge of the dendritic monocotyledons, together with some new observations, form the subject of a recent paper by Schoute.[7] On account of the slow progress of primary growth in thickness at the vegetative point, the stem is usually shaped like an inverted cone at the base, as in Pandanus; here prop-roots serve to support the stem. In the Liliiflorae, however, the inverted cone of primary growth is surrounded by a zone of secondary growth, giving the stem a cylindrical form at the base. Measurements of stems of Dracaena and other genera are given, which establish this point. Branches appear when apical growth is stopped by production of a terminal flower cluster; the growth of the branches repeats the process observed in the main stem.— M. A. CHRYSLER.

SCHUMANN has made an extensive comparative study of the ovulate flowers of the Coniferales (including Ginkgo).[8] Little attention is given to the earlier developmental stages, but the later stages and the mature flowers are described in great detail, and many suggestive comparisons are made. Teratology is not regarded as of much value in elucidating morphological relations or establishing homologies. Schumann finds that the Cupresseae are related to the Taxodieae, Sequoia being of living forms nearest the point of contact. This does not mean that Sequoia is the starting-point for the Cupressineae, but that the ancestral form must have been similar and related to Sequoia. This supports Potonié's theory that the Taxodieae appeared before the Cupresseae.— CHARLES J. CHAMBERLAIN.

IN A STUDY of the changes taking place in glucosides during metabolism, Weevers[9] finds that salicin is removed from the leaves of Salix to the bark in the dark and increases again in the leaves in light. Saligenol appears only in small quantities where salicin is decreasing in amount, quantities not large enough to account for nearly all of the salicin removed. There is found, however, an abundance of catechol in tissues from which the glucoside has disappeared, and in amounts sufficient to justify the supposition that salicin breaks down into glucose and catechol, saligenol being only an intermediate product. An enzyme active in this process could not be extracted, but it was found necessary to kill the tissues immediately in order to prevent a decrease in salicin content. Thus, the living protoplasm or a substance destroyed by boiling seems to be necessary. When glucose and catechol are produced, the carbohydrate diffuses away and the catechol remains and combines with glucose again when it becomes plentiful. Investigation of the changes in aesculin in germinating horse-chestnuts and of gaultherin in Gaultheria and Fagus were also made, but they are not yet as complete as the others.—BURTON E. LIVINGSTON.

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[7] SCHOUTE, J. C., Die Stammesbildung der Monocotylen. Flora **92** : 32–48. 1903.

[8] SCHUMANN, K., Ueber die weiblichen Blüthen der Coniferen. Verhandl. Bot. Vereins Prov. Brandenburg **44** : 5–80. 1902.

[9] WEEVERS, TH., Investigation of glucosides in connection with the internal mutation of plants. Kon. Akad. Wet. Amsterdam **1902**: 295–303. (Nov. 20.)

THE DEVELOPMENT of the spores in Selaginella has been investigated by Denke.[10] As is well known, Selaginella is a refractory object for cytological work. Denke recommends for fixing a mixture of one-third acetic acid and two-thirds absolute alcohol, and Haidenhain's iron-alum haematoxylin, with or without Congo red, for staining. He finds that the cauline sporangia originate from epidermal cells and underlying tissue. In the microsporangium a considerable number of spore mother cells fail to undergo the tetrad division. Such cells lose protoplasmic contents and function like tapetal cells. Microsporangia and megasporangia develop alike up to the spore mother cell stage and in phylogeny probably represent a common structure. In both microspore and megaspore mother cells the spindle is extranuclear in origin, and it appears while the nucleus is still in the resting stage. The spindle soon becomes bipolar and in its behavior recalls the spindle in the spermatogonia of the salamander. The formation of the membranes of the four young spores is peculiar, and, in spite of the attention which has been given to the subject, a conclusive account has not yet appeared. From the cytoplasm of the young spore, two membranes are formed one after the other. At first they grow in contact with each other, but the outer membrane by a more rapid growth becomes separated from the other, and a space appears between them. The inner layer — the mesospore — does not arise by a mere splitting of the outer layer, or exospore, as some have supposed. The delicate wall formed around each of the four young spores at the division of the spore mother cell is dissolved.— CHARLES J. CHAMBERLAIN.

GUIGNARD[11] has obtained some very interesting results from a study of *Hypecoum procumbens*, one of the Papaveraceae. Incidentally triple fusion was found to occur in the embryo sac, and the antipodals show that increase in size and prolonged activity characteristic of the antipodals of Ranunculaceae; but the chief interest centers in the unusual formation of the proembryo. The first division of the fertilized egg is transverse, as is usual, but by the enlargement of the basal cell the apical cell is thrust somewhat to one side and in this position divides at right angles to the first division. At first the two daughter cells of the second division are equal in size, but soon the upper one begins to enlarge, and becomes pyriform and approximately parallel with the origin basal cell. The three-celled proembryo thus consists of two large and inflated and presently vacuolate basal cells, lying side by side, and a small embryonal cell resting between them at their free ends. The two basal cells thus form a suspensor of most unusual origin, and remain very prominent and active during the slow development of the embryo, which is somewhat peculiar, in that it is not initiated by the longitudinal division of the embryonal cell, but by transverse divisions the embryo becomes a filament of four or five cells, whose apical and basal cells are the last to divide longitudinally.

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[10] DENKE, P., Sporenentwickelung bei Selaginella. Beihefte zum Bot. Centralbl. **12**: 182–199. *pls. 5.* 1902.

[11] GUIGNARD, L., La formation et le développement de l'embryon chez l'Hypecoum. Jour. Botanique **17**: 33–44. *figs. 21.* 1903.

The investigation traverses the account of Hypecoum given by Hegelmaier in 1878, and explains some of his inexplicable results, but at the same time introduces a proembryo and suspensor without precedent among angiosperms. The behavior of the suspensor cells after their formation resembles that found by Guignard among the Leguminosae.— J. M. C.

A RECENT PAPER read by H. Marshall Ward[12] before the Royal Society gives the results of a detailed study of the histological features of the germination, infection, and growth of the mycelium of *Uredo dispersa* in the tissue of grasses. The research has been prolonged and has involved thousands of preparations. The paper deals with the behavior of the nuclei, vacuoles, septa, branches, haustoria, and other details of the hyphae up to the commencement of spore formation.

The relations of the hyphae to the cell contents of the host are critically examined and the cumulative evidence not only fails to support Eriksson's "mycoplasm" hypothesis, but is completely subversive of it so far as histological facts are concerned. Eriksson's hypothesis, which refers the epidemic outbreaks of rust to the sudden transformation into the mycelial form of a supposed infective substance, previously latent and invisible in the cytoplasm of the host, is shown to be untenable because the *corpuscules speciaux* of this author are proved to be the cut-off haustoria of the fungus. Eriksson supposes that these *corpuscules* (haustoria) are formed by the hitherto latent germs in the host-cells, growing up in the cells into vesicles, which then pierce the cell-walls, and give rise to hyphae in the intercellular spaces. The present paper shows that Eriksson has entirely reversed the true order of events. The haustoria have been formed by the hyphae, and figures are given showing every stage in their development. The first haustorium may be formed by the infecting tube immediately after its penetration through the stoma, and figures are given showing the remains of the germ-tube outside a stoma, the swelling of its tip over the stoma into an appressorium, the passage through the stomatal cavity, and its development into a vesicular swelling whence the true infection tube arises, which latter may at once put forth a haustorium. In some cases all these latter phenomena are visible in one and the same preparation.— J. M. C.

NATHANSOHN[13] has recently made what seems to be by far the most important contribution to our knowledge of absorption and excretion which has yet appeared. Working with *Codium tomentosum*, he finds that when the plant is transferred from sea-water to a solution of $NaNO_3$, absorption of this salt occurs up to a certain limit, and then ceases. The limit of absorption seems to be determined by the concentration of the external solution, more solute being absorbed the more concentrated the latter is; but the process never continues until equality of concentration within and without the cells is even approached. This rule does not hold for sea-water, however, in which the alga accumulates $NaNO_3$ to a concentration of 0.02 per cent., although this medium contains only minute traces of the salt.

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[12] WARD, H. MARSHALL, On the histology of *Uredo dispersa* Erikss., and the "mycoplasm" hypothesis. Read March 12, 1903.

[13] NATHANSOHN, ALEXANDER, Ueber Regulationserscheinungen im Stoffaustausch Jahrb. Wiss. Bot. **38**: 241–290. 1902.

Further than this, if the alga be placed for a day in a 5 per cent. solution of $NaNO_3$, and then be transferred to a 3 per cent. solution of the same salt, absorption occurs in the stronger solution until the limit for that solution is reached, but after the transfer $NaNO_3$ is lost by the cells until the internal concentration has fallen to the limit for the weaker solution. Since the limit of absorption, even for the stronger solution, lies far below 3 per cent., this outward passage of the salt takes place from a lower to a higher concentration, and therefore in the direction opposite to that in which it should move according to the principles of diffusion of solutes.

The cells contain a large amount of NaCl when taken from sea-water. This salt diffuses outward in $NaNO_3$ solutions until a certain minimum of internal concentration of NaCl is reached, and this minimum limit is lower, the weaker is the external solution of the other salt. The internal concentration of the chlorid never even approaches its external concentration; thus this stoppage of outward diffusion of NaCl is parallel with the cessation of absorption in the case of the nitrate. There is no evidence of accumulation of either salt in the protoplasm, neither is the solubility of either salt different in the cell sap from its solubility in sea-water.

Further, if Codium plants be placed in a solution containing both $NaNO_3$ and NaCl (the latter salt being always of the same concentration, while the former is varied in amount), diffusion of the chlorid takes place either outward or inward according to the concentration of the nitrate without. Thus, if the concentration of $NaNO_3$ is 1 per cent. the plant loses chlorid; if it is 2 or 3 per cent., chlorid is absorbed, and this diffusion occurs whether the chlorid is moving with or against its diffusion tension. The usual principles of diffusion seem not to apply here at all.

This is the first unquestionable evidence that the living membrane in plants can overcome the osmotic pressure of a solute and cause its movement from lower to higher concentration. The phenomenon has been known in animals, however. The paper contains a large amount of suggestive theoretical discussion.—BURTON E. LIVINGSTON.